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AUTHOR Orsak, Charles; Green, C. Paul
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ABSTRACT

Designed for practical hands-on secondary and postsecondary vocational programs and adult/continuing education programs, this eleven-module curriculum was developed to equip both male and female students with the capabilities to identify, monitor, manage, and curb energy usage in their daily lives and vocational pursuits. It is intended for use as support material for existing related curricula. Each module may be used independently, collectively with the other modules in a course or program on energy conservation, or integrated into conventional courses. Topics include (1) awareness of the energy dilemma, (2) surveying energy usage, (3) understanding utility bills, (4) how to search for energy conservation opportunities, (5) lighting conservation opportunities, (6) hot water heating conservation opportunities, (7) appliance energy conservation opportunities, (8) building construction versus energy consumption, (9) human comfort and energy conservation, (10) heating, ventilating, and air conditioning conservation opportunities, and (11) economics of energy conservation. Each module is divided into units to give the instructor flexibility in selecting support materials. The basic format for the modules is module description, goal statement, and unit outlines with specific objectives. (YLB)

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The Design and Development of a Curriculum in Energy Conservation to Train Secondary and Post-Secondary Vocational Students

Charles Orsak and C. Paul Green
Navarro College
Corsicana, Texas

OBJECTIVES

NAVARRO COLLEGE has developed an eleven module curriculum in energy conservation designed for practical hands-on

-secondary vocational programs,
-post-secondary vocational programs,
-adult/continuing education programs.

to equip both male and female vocational students with the capabilities to identify, monitor, manage, and curb energy usage in their daily lives and vocational pursuits.

DESIGN

The curriculum can be used to support existing related curricula in the community college, technical school, secondary vocational school, and adult/continuing education program in such fields as:

-home economics
-agriculture
-building trades
-electronics
-air conditioning and refrigeration
-automotive
-economics
-cooperative education
-physics
-biology.

Each module is intended for use independently, collectively with the other ten into a program or course on energy conservation, or integrated into conventional vocational courses.

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FORMAT

The curriculum has been designed in eleven modules. Each module has been divided into units or blocks of instruction to give an instructor flexibility to select pertinent material to support particular ideas and concepts.

The curriculum has many advantages/characteristics:

-timely
-comprehensive
-modular design
-flexible format
-module description
-goal statements
-learning objectives
-text/lecture
-hands-on- laboratory applications
-pre-tests
-post-tests
-vocabulary/terminology
-charts and tables
-reproducible transparencies
-summaries
-selected bibliography
-pilot tested.

There is an accompanying video tape which describes the curriculum and explains how each module fits into specific vocational programs.

MODULE #1
AWARENESS OF THE ENERGY DILEMMA

MODULE DESCRIPTION

The objective of this module is to instill awareness that there is a growing crisis in energy supply. Therefore, attention and concern must be evidenced by all citizens in order for conservation to take place and energy to be available for future use.

An overview is made of energy supply sources including oil, gas, coal, nuclear, and hydro-electric power. A survey is made of potential or alternate energy sources which are getting much attention at present. These include solar power, wind, geothermal, tidal power, ocean thermal, biomass, and others. Types and amounts of energy used are discussed and uses of energy are outlined. Finally, an overview of energy opportunities and their problems are listed.

The United States "oil production has been declining since 1970, while usage continues to increase. The importing of foreign oil means the exporting of dollars: - in 1970, the U.S. spent $3 billion for foreign oil ... $15 for every American. In 1977, the U.S. spent $34 billion for oil, or $160 for every man, woman and child in the U.S." The U.S., which represents 6% of the world population, uses 1/3 of the world's production of energy. This imbalance presents serious problems in terms of the challenge to America's lifestyles prompted by declining sources of inexpensive fuels.

This block of instruction is an introductory overview of the energy problems facing the nation. The module presents a survey of energy resources, an examination of energy uses, and a discussion of the potential for alternate energy sources which are receiving considerable attention at present.

GOAL STATEMENT

Upon completion of this module, the student will be able to:

a. Exhibit an understanding of energy sources and alternate sources available to present day society;

b. Demonstrate an understanding of energy uses in the U.S. society;

c. Indicate a better understanding of the disproportionate use of energy today in contrast to cultures and societies of the past and present which were less energy-oriented.

TABLE OF CONTENTS

UNIT 1: Energy Sources

A. Changing Energy Sources/Uses
B. Fossil Fuels
C. Fossil Fuels in Texas
   1.) Oil and Gas in Texas
   2.) Coal in Texas
D. Energy Depletion Rates
E. The Energy Crisis

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Recognize the conventional sources of energy in the U.S.

2. Discuss the historical change in dependency on these fuels.

3. Relate the role of Texas in the U.S. production of energy.

4. Appreciate the rate of fossil fuel depletion.

5. Discuss the three types of energy crises existing in the world today.

UNIT 2: Renewable/Alternate Energy Sources

A. Biomass Conversion
B. Solar Energy
C. Wind Energy
D. Ocean Sources
   1.) Ocean Thermal Energy Conversion
   2.) Tidal Generators
E. Geothermal
F. Nuclear
   1.) Conventional Reactors
   2.) Breeder Reactors
   3.) Nuclear Fusion
G. Oil Shale
H. Tar Sands
I. Problems

Summary

OBJECTIVES: Upon completion of this unit, the student will be able to:

1. Recognize alternate sources of energy used and proposed for today's use.

2. Understand some of the problems related to these alternate sources of energy.

MODULE #2
SURVEYING ENERGY USAGE

MODULE DESCRIPTION

This module presents an overview of energy usage in the United States in each of four broad categories of use: residential and commercial, industrial, agricultural, and transportation. The importance of energy to each of these areas and their substantial reliance on energy for survival makes the student aware of the need for energy conservation measures. Proposed solutions are examined for practicality and adaptability.

GOAL STATEMENT

The objective of this module is to train secondary and post-secondary students to recognize energy needs and energy consumption patterns in several areas of use. Further, the module prompts a search for conservation measures in each use area: residential/commercial, industrial, agricultural, and transportation.

TABLE OF CONTENTS

UNIT 1: Residential/Commercial Energy Use and Conservation

A. Household Needs
B. Methods of Conservation
C. Commercial Energy Use

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Understand energy needs and uses in the U.S. household.

2. Discuss methods of energy conservation available to the homeowner, including insulation, weatherstripping, and general maintenance tips.

3. Recognize energy uses peculiar to the U.S. commercial sector and discuss conservation methods to improve energy consumption efficiency.

UNIT 2: Industrial Energy -- Use and Conservation

A. Industrial Energy -- Conservation
B. Energy Management
C. Waste Heat Recovery
D. Recycling

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Recognize the use and consumption of energy in the industrial sector of the U.S.

2. Discuss the sources of industrial energy supply.

3. Discuss conservation measures available to industry through energy management.

4. Discuss conservation measures available to industry through waste heat recovery.

5. Discuss conservation measures available to industry through recycling.

UNIT 3: Agricultural Energy -- Use and Conservation

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Appreciate the sources and amount of energy required to produce food and services through agriculture.

2. Understand the importance of agriculture in the U.S. being "energy intensive" and the influence it has had on this field.

3. Recognize the correlation between number of people fed and the amount of land and energy required per capita.

UNIT 4: Transportation: Energy Use and Conservation

A. The Automobile
B. Problems in Transportation
   1.) Regulations vs. Economy
   2.) Inter-city Travel
   3.) Commuter Problems
C. Proposed Solutions
   1.) Conservation, Regulations, Driving Habits, and Engine Changes
   2.) Alternatives to Fossil Fuels
      a.) Electricity
      b.) Other Combustion Fuels

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Recognize the importance of transportation to the economy of any nation.

2. Discuss the amount of the nation's energy budget which goes for transportation.

3. Appreciate the energy consumption of the automatic versus car pooling and public transportation.

4. Recognize and discuss problems associated with energy conservation measures in transportation.

5. Be aware of proposed solutions for making transportation in the U.S. more energy efficient.

6. Discuss alternate fuel solutions to fossil fuels for use in transportation.

MODULE #3
UNDERSTANDING UTILITY BILLS

MODULE DESCRIPTION

The student will be introduced to the utility bills used for residential and commercial customers. The electric bill will be discussed in terms of terminology and definition, cost breakout, meter readings, and rate schedules. Natural gas utility bills will be discussed in terms of terminology and definitions, heat content, cost per unit, meter reading, and rate schedules. The types of utility meters will be discussed as monitoring devices for the amount of energy used. Demand meters and energy indicators must be identified and understood in order for the particular knowledge learned to be generalized.

The American consumer is made aware of the energy he or she consumes by receiving a periodic utility bill. This bill expresses the amount of energy used, the price per unit or rate of charge, and the amount of money due for this expense. The bill is based on the number of utility units used as indicated on the utility meter. In order to monitor the amount of energy used so that energy conservation measures can be evaluated, the student must know how to read utility meters.

TABLE OF CONTENTS

UNIT 1: Electric Meters

OBJECTIVES: At the completion of this unit the student will be able to:

1. Describe how an elctric wattmeter works.

2. Explain how to read a home electric meter for watt-hour electrical consumption.

UNIT 2: Electric Rates

A. Meter Rates
   1.) Straight Line Meter Rate
   2.) Step Meter Rate
   3.) Block Meter Rate
B. Demand Rates
   1.) Flat Demand Rate
   2.) Wright Demand Rate
   3.) Hopkinson Demand Rate
   4.) Three-Part or Three-Charge Rate

OBJECTIVES: At the completion of this unit the student will be able to:

1. Discuss the various electric rate schedules available for electric companies to determine the cost of electricity to the customer.

2. Distinguish between demand rates and meter rates for electric billings.

3. Understand and compute electric costs using straight line meter rates, step meter rates, and block meter rates.

4. Understand and compute electricity costs using flat demand rates, Wright demand rates, Hopkinson demand rates, and three-part or three-charge rates.

UNIT 3: The Electric Bill

A. Texas Power and Light Company
B. Texas Power and Light Rate Schedule

OBJECTIVES: At the completion of this unit the student will be able to:

1. Read and understand the household electric bill.

2. Explain the meaning of each block listed on the bill and determine what type of billing is used.

3. Determine the amount of electricity used within a month and if it is billed correctly.

4. Utilize the bill as an energy conservation management tool.

5. Be familiar with the specific electric rates set by the Texas Power and Light Company for certain cities in Texas.

UNIT 4. Gas Meters and Gas Rates

A. Gas Meters
B. Gas Rates
    1.) Straight Line Rate
    2.) Step Rate
    3.) Block Rate
    4.) Block Rate with Small Initial Block which Constitutes Minimum Monthly Bill
    5.) Service Charge Rate with Straight Line Consumption Charge
    6.) Flat Rate
    7.) Wright Demand Rate
    8.) Two-Part Rate

OBJECTIVES: At the completion of this unit the student will be able to:

1. Understand how a gas meter works.

2. Read a gas meter.

3. Understand the various types of gas rates available to gas companies.

4. Compute gas costs using any of the eight types of rate schedules discussed.

UNIT 5. The Gas Bill

A. Lone Star Gas Bill
B. Lone Star Gas Rate Schedule

OBJECTIVES: At the completion of this unit the student will be able to:

1. Read a gas bill and appreciate the information it gives.

2. Be familiar with the Lone Star Gas Company rate schedule for various cities in Texas.

MODULE #4
HOW TO SEARCH FOR ENERGY CONSERVATION OPPORTUNITIES

MODULE DESCRIPTION

This module emphasizes the importance of recognizing energy users in the home and developing a conscious awareness of energy efficiency and energy management. It discusses the techniques of looking for energy conservation opportunities in the home and preparing checklists for monitoring these opportunities. Such points as usage versus load investigation, occupancy rates, and waste awareness are discussed in this module.

GOAL STATEMENT

The objective of this module is to train secondary and post-secondary students in the recognition of energy users in the home and the implementation of energy conservation measures to manage energy consumption and energy efficiency.

TABLE OF CONTENTS

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Identify energy users in the home.

2. Identify and discuss the steps necessary to accomplish energy management.

3. Identify energy management measures available in the home.

STEP 1: Walk Through Inspection
STEP 2: Amount of Time Used
STEP 3: Meter Readings
STEP 4: Historical Usage Data
SUMMARY: Energy Conservation Methods for Various Applications and Activities.

MODULE #5
LIGHTING CONSERVATION OPPORTUNITIES

The student will be introduced to the types of lighting fixtures used in residences and commercial buildings and will be able to compare them in terms of energy usage, light output (that is foot candles or lumens per watt), and heat output. Discussion will include the required lighting levels for certain tasks and activities, color definitions, and time elements for usage. The survey of conservation opportunities in lighting will include an analysis of cost and benefits in energy used or saved. The module concludes with suggested implementation of lighting conservation opportunities.

GOAL STATEMENT

The objective of this module is to train secondary and post-secondary students to recognize energy-related factors in lighting, including differences in light bulbs and fixtures. Further, it is to enable the student to implement conservation techniques for lighting use in both residential and commercial settings.

TABLE OF CONTENTS

UNIT 1: Lighting Efficiency

A. Use Fewer Bulbs to Save Money
B. Lamp Life
C. Fluorescent Lights
D. Lights Produce Heat Energy

OBJECTIVES: At the completion of this unit the student will be able to:

1. Distinguish the characteristics of incandescent and fluorescent light bulbs and fixtures.

2. Discuss the relative efficiency of incandescent, incandescent long-life, and fluorescent bulbs.

3. Discuss lamp life differences among various types of light bulbs.

4. Discuss the various types of fluorescent bulbs, their uses, and characteristics.

5. Explain the advantages and disadvantages of lamp heat produced by various bulb types.

UNIT 2: Estimating Lighting Requirements

OBJECTIVES: At the completion of this unit the student will be able to:

Calculate lumen requirements and light bulb recommendations for various locations or task activities.

UNIT 3: Tips for Better Lighting Efficiency

OBJECTIVES: At the completion of this unit the student will be able to:

Discuss lighting conservation tips and apply them to actual situations.

MODULE #6
HOT WATER HEATING CONSERVATION OPPORTUNITIES

MODULE DESCRIPTION

The types of hot water heaters are discussed and compared to ascertain the operating characteristics and the efficiency of each from the standpoint of input energy, heat loss, and recovery capacity. Hot water temperature variances for specific household uses are discussed for appliances such as dishwashers and clothes washers. Personal hygiene in using showers versus baths, water use habits for shaving, rinsing items, and related activities are discussed for various family sizes. Water use and control for food preparation and kitchen use are outlined. Flow rates for water consumption are explained and costs versus benefit analysis in hot water conservation opportunities are surveyed.

In addition to hot water use, water use and water conservation activities for cold water are discussed as indirect and direct energy users in the home and at the power plant. Finally, solar water heating is discussed as a potential alternative to using conventional energy to heat water in the home.

GOAL STATEMENT

The objective of this module is to train secondary and post-secondary students in the recognition, implementation, and utilization of energy consumption and possible conservation in residential hot water heating and domestic hot water use.

TABLE OF CONTENTS

UNIT 1: Domestic Hot Water Use

A. Hot Water Heaters
B. Energy Saving Tips for Hot Water Use
   1.) General
   2.) Personal Hygiene
   3.) Kitchen and Laundry

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Appreciate and discuss the substantial amount of energy required to supply hot water for domestic use.

2. Recognize the characteristics and operational features of various electric and gas water heaters.

3. Discuss the reasons for and compute the operational cost differences between gas and electric water heaters.

4. Discuss routine maintenance steps the customer can perform to increase the efficiency of the home water heater.

5. Formulate a philosophy of energy conservation in using hot water for personal hygiene, kitchen, and laundry use.

UNIT 2: Water Conservation

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Appreciate and explain the amount of cold water used in the home for various activities.

2. Discuss water saving opportunities in the home.

3. Explain the direct and indirect energy use for producing and supplying water for consumer use.

Unit 3: Consider Solar Water Systems

A. Solar Energy Systems
B. Kinds of Systems
C. The Final Decision

MODULE #7
APPLIANCE ENERGY CONSERVATION OPPORTUNITIES

MODULE DESCRIPTION

The student will be introduced to various household and small commercial appliances. These appliances will be discussed in terms of their operations, energy usage, efficiency ratings, and cost of operation. Alternatives to use of these appliances and method for making their use more efficient will be presented. A survey of energy usage by these appliances will be provided with a discussion of the benefits of applying available energy conservation opportunities. The student will learn to determine the energy efficiency ratings of appliances and apply the ratings to energy conservation opportunities.

GOAL STATEMENT

The objective of this module is to train secondary and post-secondary students in the recognition, implementation, and utilization of energy consumption and possible opportunities for conservation in the use of residential and small commercial appliances.

TABLE OF CONTENTS

UNIT 1: Appliance Energy Use

A. Refrigerator/Freezer
B. Cooking
C. Dishwasher
D. Washing Machine
E. Clothes Dryer
F. Minor Appliances
G. Appliance Energy Conservation Tips

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Appreciate the amount of energy consumed by appliances used in the home.

2. Read appliance labels to determine kilowatt-hour usage.

3. Compute the expense of operating various household appliances.

4. Determine steps to be taken to improve the energy efficiency of home refrigerators and freezers.

5. Discuss energy conservation measures in using cooking appliances.

6. Discuss efficient use of a dishwasher.

7. Discuss laundry appliances and conservation measures for their use.

8. Recognize energy efficiency factors in purchasing and using minor appliances.

UNIT 2: The Appliance Labeling Program

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Discuss the appliance labeling program established by Congress.

2. Discuss the advantages and disadvantages of the Federal Trade Commission's labeling program.

MODULE #8
BUILDING CONSTRUCTION VERSUS ENERGY CONSUMPTION

MODULE DESCRIPTION

This module discusses heat transfer in buildings, such as heat conduction, convection, radiation, and evaporation. Heat loss and heat gain characteristics and values are discussed in terms of air infiltration, glazing, insulation, and thermal mass. Building site selection, orientation, and shading, as well as building codes and regulations, are presented as considerations necessary prior to construction.

Calculating heat loss and gain, while utilizing weather data and discussing cost and benefit analysis of conservation opportunities, makes up a major portion of this module. A student workbook for surveying heat loss and heat gain in a home is provided along with formulas to determine costs and savings for implementing certain energy conservation measures.

GOAL STATEMENT

The objective of this module is to train secondary and post-secondary students in the recognition, implementation, and utilization of energy consumption and possible conservation in building construction and design.

TABLE OF CONTENTS

UNIT 1: Construction Consideration Before Building

A. Home Energy Consumption
B. Home Energy Conservation Potential
C. Methods of Transferring Heat
D. Building Codes

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Recognize energy conservation potential in home building and remodeling.

2. Discuss and recognize the importance of building codes and the problems associated with them.

3. Discuss and recognize the three types of heat transfer.

UNIT 2: Building Site and Design

A. Orientation
B. Glazing
C. Insulation

1). The K Factor
2). The U Factor
3). The R Factor
4). Types of Insulation

D. Walls
E. Ceilings
F. Shading Devices
G. Building Mass

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Recognize the significance in building orientation.

2. Discuss the significance of designing houses to utilize wall and glass area to control heat loss and heat gain.

3. Discuss the relationship between floor area and percentage of glazed area.

4. Compute annual estimated heating and cooling cost savings for installing energy conservation measures, such as storm doors and windows.

5. Explain the meanings of: K factor, U factor, and R factor, and to compute each for certain building materials.

6. Distinguish between various types of insulation material.

7. Recognize the significance in heat loss in wall, ceiling, and glazed areas, and to insulate for better efficiency.

8. Discuss the advantages of shading devices for saving energy.

9. Discuss the effects of building mass on energy conservation.

UNIT 3: Weatherization

A. Windows
B. Doors
C. Caulking
D. Energy Conservation Measures
1.) During the Heating Season
2.) During the Cooling Season

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Discuss weatherization practices available to the homeowner for more efficient doors.

2. Discuss weatherization practices available to the homeowner for more efficient windows.

3. Identify various types of caulking compounds and their life expectancy.

4. Discuss the advantages of caulking for saving energy.

5. Identify and discuss conservation practices in the home during the heating season.

6. Identify and discuss conservation practices in the home during the cooling season.

UNIT 4: Weatherization Workbook

OBJECTIVE: Upon completion of this unit the student will be able to:

1. Survey the home and compute for heat loss by infiltration.

2. Survey the home and compute for heat loss by conduction through floors.

3. Survey the home and compute for heat loss by conduction through ceilings.

4. Survey the home and compute for heat loss through single-glass windows.

5. Survey the home and compute for heat loss through double-glass or plastic-covered windows, and through doors.

6. Survey the home and compute for heat losses through walls.

7. Calculate cost savings for implementing conservation measures in each of the above areas.

MODULE #9
HUMAN COMFORT AND ENERGY CONSERVATION

MODULE DESCRIPTION

This module is an introductory study of the integration of human comfort variables and the ways energy is used to maintain human comfort. These variables include physical, demographic, and personal differences which affect the relationship between human comfort and energy use. Some of the variables examined include: air temperature, humidity, air movement, geographical location, age differences, type of activity engaged in, food and beverage consumed, and kinds of clothing worn.

TABLE OF CONTENTS

UNIT 1: The Nature of Thermal Comfort in Humans.

A. Thermal Energy in Humans and Other Animal
B. Effects of Heat and Cold
C. Survival and Comfort
D. Clothing, Food, Water, and Health

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Discuss the basic facts of thermal energy generation from food.

2. Discuss the process of conservation of thermal energy by the human body.

3. Describe heat losses and heat gains as they relate to:

a. human survival,
b. human comfort,
c. clothing,
d. food/water intake, and
e. human health.

UNIT 2: How Natural Climates and Artificial Environments are Defined.

A. Characteristics of Hot and Cold
B. Air Movement and Humidity
C. Natural Outdoor Conditions vs. Season and Geography
D. How Human Comfort Zones are Measured

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Discuss the effects of air temperature, humidity, and wind speed on the human body and skin temperature.

2. Identify and discuss the changes in heat balance produced by air movement, humidity, and seasonal weather conditions.

3. Identify and discuss characteristic climates of Texas cities.

4. Discuss and plot characteristic climates of Texas cities on a comfort chart.

UNIT 3: Controlling Buildings for Thermal Comfort.

A. Occupancy and Duration
B. Activity and Clothing
C. Workplaces vs. Homes
D. Energy-Saving Options

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Explain and discuss reasons thermal controls in homes and workplaces need to be set in accordance to occupancy and duration of stay.

2. Explain and discuss why and how activity and clothing are important in achieving heat balance and human comfort.

3. Define active control measures for achieving human comfort and energy conservation.

4. Define and discuss passive control measures for achieving human comfort and energy conservation.

MODULE #10
HEATING, VENTILATING, AND AIR CONDITION
CONSERVATION OPPORTUNITIES

MODULE DESCRIPTION

This module discusses the principles of heating and cooling in buildings such as heat loss, heat gain, heating loads, and cooling loads. Heating load and cooling load characteristics for sizing home heating and cooling equipment requirments are discussed in terms of relative humidity and summer and winter design temperatures.

Heating and cooling equipment are presented in terms of components of operation, energy efficiency ratings, and equipment energy usage and design. Ductwork is explored as the delivery system of home conditioned air. Cost/benefit analysis of energy conservation opportunities in heating, ventilating, and air conditioning are explored in the areas of equipment operation, maintenance, and control.

GOAL STATEMENT:

The objective of this module is to train secondary and post-secondary students in the recognition, implementation, and utilization of energy consumption and possible conservation in heating, ventilating, and air conditioning.

TABLE OF CONTENTS

UNIT 1: Fundamentals of Heating and Cooling.

A. Energy Units
B. Temperature Differences
C. Humidity

OBJECTIVES: Upon completion of this unit the student will be able to:

a. Discuss energy use in the U.S. in terms of types of fuel used for various activities.

b. Identify units of measurement for energy fuel used in heating and cooling.

1. Watt
2. Kilowatt
3. British Thermal Unit (BTU)
4. Cubic foot (CFM)

c. Define terms related to heating and cooling fundamentals:

1. Heat Load
2. Heat Gain
3. Cooling Load
4. Tons of Refrigeration
5. Energy Efficiency Ratio
6. Temperature Difference
7. Summer Design Temperature
8. Winter Design Temperature
9. Inside Temperature
10. Relative Humidity
11. Humidifier
12. Dehumidifier
13. Ventilation
14. Infiltration

UNIT 2: Heating Systems

A. Forced Air Components
B. Sizing a Heating System
C. Fuel Costs
D. Heating System Efficiency
    1. Fuel Furnances
    2. Electric Furnaces
    3. Heat Pumps
    4. Electric Baseboard Heaters
E. Maintenance
    1. Filters
    2. Fans
    3. Adjusting LPG and Natural Gas Furnaces
        a. Gas Valves
        b. Adjusting the Burners
        c. Cleaning the Burners
        d. Adjusting the Gas Pressure
        e. Adjusting the Pilot Light
    4. Electric Furnaces
        a. Maintaining the Fan
        b. Checking the Thermostat
F. Humidifiers
    1. Operation and Maintenance
    2. Fuel Savings
G. Space Heaters
H. Energy Saving Tips for Heating

OBJECTIVES: Upon the completion of this unit the student will be able to:

a. Identify the components of a forced air heating system.

b. Calculate heat loss in a home.

c. Size a heating system for a particular home heating need.

d. Explain the difference in fuel costs among energy fuels available for heating use.

e. Recognize and implement measures to improve energy efficiency in heating systems.

f. Discuss differences in efficiency among gas, oil, electric, and heat pump central systems, and baseboard and space heaters.

g. Discuss maintenance measures for heating systems.

h. Discuss the role of humidifiers in heating a home.

UNIT 3: Cooling Systems

A. Air Conditioner Components
B. Types of Air Conditioners
   1. Room Air Conditioners
   2. Central Air Conditioning Systems
C. Sizing a Cooling System
D. Maintenance and Use
E. Dehumidify in Summer
F. Tips for Cooling Energy Savers

OBJECTIVES: Upon completion of this unit the student will be able to:

a. Identify the components of a typical air conditioner.

b. Distinquish between the uses of room air conditioners and central air conditioning systems.

c. Calculate and size an air conditioner for a particular cooling need.

d. Discuss maintenance and use tips for efficient air conditioning performance.

e. Discuss the role of dehumidifiers in summer cooling.

UNIT 4: Duct Work

A. Calculation of Duct Size
B. Types of Ducts
C. Duct System Designs
D. Insulation of Ducts

OBJECTIVES: Upon completion of this unit the student will be able to:

a. Calculate duct size needed to supply conditioned air to various rooms in a home.

b. Distinquish between types of ducts and duct material.

c. Discuss the operating specifications of ducts and registers.

d. Discuss various duct piping arrangements for certain types of building constructions:

1. Extended Plenum System
2. Radial Piping System

e. Recognize the importance of duct insulation.

MODULE #11
ECONOMICS OF ENERGY CONSERVATION

MODULE DESCRIPTION

This module is designed to be practical in nature discussing the cost of energy conservation measures and the savings and benefits in energy and dollars for implementing them. Initial and front-end costs are discussed in terms of payback periods and amortization of investment. The student will learn to develop an overall energy conservation plan by identifying energy usage savings through operational tradeoffs, cost of implementation, and prioritizing energy conservation measures. Auditing procedures for energy conservation are also discussed.

GOAL STATEMENT

The objective of this module is to train secondary and postsecondary students in the recognition, implementation, and utilization of energy economics in energy consumption and possible energy conservation.

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UNIT 1: Energy Use and Demand Profiles.

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Discuss the prevailing American philosophy toward energy.

2. Explain the analysis of cash flow from income.

3. Discuss the difference between baseline load for utilities versus the instantaneous load demand.

4. Recognize the baseline load and peak demand periods during the year for natural gas and electricity.

5. Discuss the various forms of generating electricity for domestic use.

UNIT 2: Energy Use and Demand Profiles in the Home.

A. Appliances
B. Lighting
C. Energy Conservation for Cars

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Identify different appliances in the home and determine the cost of operation for each.

2. Determine the efficiency and cost of operation for various types of lighting.

3. Identify and discuss efficiency of an automobile.

4. Discuss energy conservation measures in handling, driving, and repairing an automobile.

UNIT 3: Energy Conservation Methods and Trade-Offs.

A. Heating and Cooling -- Trade-offs
B. Energy Heating and Cooling -- Conservation Methods

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Discuss two methods of energy conservation as trade-offs:

a. Reduction of unnecessary use.
b. Planned usage to reduce peak demands.

2. Identify trade-offs in utilizing heating and cooling equipment.

3. Identify energy conservation methods in heating and cooling equipment and operation.

UNIT 4: Energy Costing and Accounting

A. Costs for Insulation
B. Developing Your Own Energy Conservation Priorities
C. A Summary of Energy Conservation Methods

OBJECTIVES: Upon completion of this unit the student will be able to:

1. Determine energy costs versus efficiency of operation for appliances.

2. Determine cost investment and savings for insulation materials.

3. Determine payback periods for conservation measures as opposed to various types of conventional fossil fuels for heating.

4. Determine and prioritize retrofit measures for energy conservation in the home.